

CLAIMS

1. A liquid crystal display apparatus that corrects optical response characteristics of a liquid crystal display panel, by subjecting image data supplied to the liquid crystal display panel to enhancing conversion at least in accordance with image data of a directly previous vertical period and image data of a current vertical period,

the liquid crystal display apparatus comprising:

signal type detection means for detecting whether a signal type of input image data is a progressive signal or an interlace signal;

I/P conversion means for converting an interlace signal to image data that is a progressive signal, if the input image data is an interlace signal; and

enhancing conversion means for subjecting the image data to the enhancing conversion, in such a manner as to cause the liquid crystal panel to have a transmittance indicated by the image data, within a predetermined period of time,

in accordance with a result of detection by the signal type detection means, a degree of the enhancing conversion of the image data by the enhancing conversion means being varied.

2. The liquid crystal display apparatus as defined in claim 1, further comprising a table memory that stores an enhancing conversion parameter specified by the image data of the current vertical period and the image data of the directly previous vertical period,

the enhancing conversion means including:

an operation section that performs an operation on the image data so as to enhance the image data, using the enhancing conversion parameter; and

a multiplying section that multiplies output data of the operation section by a coefficient corresponding to the result of the detection by the signal type detection means.

3. The liquid crystal display apparatus as defined in claim 2, wherein, the coefficient in a case where the input image data is an interlace signal is smaller than the coefficient in a case where the input image data is a progressive signal.

4. The liquid crystal display apparatus as defined in claim 1, further comprising:

a first table memory that stores an enhancing conversion parameter specified by the image data of the current vertical period and the image data of the directly previous vertical period, the first table memory being referred to when the

input image data is a progressive signal; and

a second table memory that stores an enhancing conversion parameter specified by the image data of the current vertical period and the image data of the directly previous vertical period, the second table memory being referred to when the input image data is an interlace signal,

the enhancing conversion means including an operation section that performs, using the enhancing conversion parameter read out from the first or second table memory in accordance with the result of the detection by the signal type detection means, an operation on the image data so as to enhance the image data.

5. The liquid crystal display apparatus as defined in claim 4, wherein, the enhancing conversion parameter in a case where the input image data is a progressive signal is smaller than the enhancing conversion parameter in a case where the input image data is an interlace signal.

6. The liquid crystal display apparatus as defined in claim 1, further comprising:

temperature detection means for detecting a temperature in the liquid crystal display apparatus,

the enhancing conversion means varying the degree of the enhancing conversion of the image data, in accordance

with a result of detection by the temperature detection means.

7. The liquid crystal display apparatus as defined in claim 6, further comprising a table memory that stores an enhancing conversion parameter specified by the image data of the directly previous vertical period and the image data of the current vertical period,

the enhancing conversion means including:

an operation section that performs an operation on the image data so as to enhance the image data, using the enhancing conversion parameter; and

a multiplying section that multiplies output data of the operation section by a coefficient corresponding to the result of the detection by the signal type detection means and the result of the detection by the temperature detection means.

8. The liquid crystal display apparatus as defined in claim 6, further comprising:

a first table memory that stores an enhancing conversion parameter specified by the image data of the current vertical period and the image data of the directly previous vertical period, the first table memory being referred to when the input image data is a progressive signal; and

a second table memory that stores an enhancing conversion parameter specified by the image data of the

current vertical period and the image data of the directly previous vertical period, the second table memory being referred to when the input image data is an interlace signal,

the enhancing conversion means including:

5 an operation section that performs, using the enhancing conversion parameter read out from the first or second table memory in accordance with the result of the detection by the signal type detection means, an operation on the image data so as to enhance the image data; and

10 a multiplying section that multiplies output data of the operation section by a coefficient corresponding to the result of the detection by the temperature detection means.

15 9. The liquid crystal display apparatus as defined in claim 6, further comprising:

 first table memories that store enhancing conversion parameters that correspond to respective temperatures in the liquid crystal display apparatus and are specified by the image data of the current vertical period and the image data of the directly previous vertical period, the first table memories being referred to when the input image data is a progressive signal; and

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 second table memories that store enhancing conversion parameters that correspond to respective temperatures in the liquid crystal display apparatus and are specified by the

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image data of the current vertical period and the image data of the directly previous vertical period, the second table memories being referred to when the input image data is an interlace signal,

5 the enhancing conversion means including an operation section that performs, using the enhancing conversion parameter read out from the first or second table memory in accordance with the result of the detection by the signal type detection means and the result of the detection by the
10 temperature detection means, an operation on the image data so as to enhance the image data.

10. The liquid crystal display apparatus as defined in claim 6, further comprising a table memory that stores
15 enhancing conversion parameters that correspond to respective temperatures in the liquid crystal display apparatus and are specified by the image data of the current vertical period and the image data of the directly previous vertical period,

20 the enhancing conversion means including an operation section that performs, using the enhancing conversion parameter read out from the table memory, an operation on the image data so as to enhance the image data, in accordance with a result of comparison between (i) a
25 switching temperature determined by the result of the detection by the signal type detection means and (ii) the

result of the detection by the temperature detection means.

11. The liquid crystal display apparatus as defined in claim 10, further comprising:

5 a control section that controls switching and selection of the enhancing conversion parameters,

the control means including:

an operation section that performs, on temperature data detected by the temperature detection means, a
10 predetermined operation corresponding to each signal type of the input image data;

a threshold discriminating section that compares the temperature data, which has been subjected to the operation by the operation section, with predetermined threshold
15 temperature data; and

a control signal output section that generates a switching control signal with which the enhancing conversion parameters are switched and controlled, in accordance with a result of detection by the threshold discriminating section.

20 12. The liquid crystal display apparatus as defined in claim 10, further comprising

control means that controls switching and selection of the enhancing conversion parameters,

25 the control means including:

a threshold discriminating section that compares the

temperature data detected by the temperature detection means with predetermined temperature data corresponding to each signal type of the input image data; and

5 a control signal output section that generates a switching control signal with which the enhancing conversion parameters are switched and controlled in accordance with a result of detection by the threshold discriminating section.

10 13. A liquid crystal display control method for correcting optical response characteristics of a liquid crystal display panel, by subjecting image data supplied to the liquid crystal display panel to enhancing conversion at least in accordance with image data of a directly previous vertical period and image data of a current vertical period,

15 the method comprising the steps of:

(i) detecting whether a signal type of input image data is a progressive signal or an interlace signal;

20 (ii) converting the interlace signal to image data that is a progressive signal, if the input image data is an interlace signal; and

(iii) subjecting the image data to the enhancing conversion, in such a manner as to cause the liquid crystal panel to have a transmittance indicated by the image data, within a predetermined period of time,

25 in accordance with a result of detection of the signal type, a degree of the enhancing conversion of the image data

being varied.

14. The liquid crystal display control method as defined in claim 13, further comprising the steps of:

5 (iv) referring to a table memory that stores an enhancing conversion parameter specified by the image data of the directly previous vertical period and the image data of the current vertical period;

10 (v) performing an operation on the image data so as to enhance the image data, using the enhancing conversion parameter; and

(vi) multiplying output data as a result of the step (v) by a coefficient corresponding to the signal type detected in the step (i).

15 15. The liquid crystal display control method as defined in claim 13, further comprising the steps of:

20 (iv) referring to a table memory that stores an enhancing conversion parameter specified by the image data of the directly previous vertical period and the image data of the current vertical period, the table memory being referred to in a case where the input image data is a progressive signal;

25 (v) referring to a table memory that stores an enhancing conversion parameter specified by the image data of the directly previous vertical period and the image data of the current vertical period, the table memory being referred to in

a case where the input image data is the interlace signal; and
performing an operation on the image data so as to
enhance the image data, using the enhancing conversion
parameter read out from the table memory in accordance with
5 the signal type detected in the step (i).

16. The liquid crystal display control method as defined
in claim 13, further comprising the steps of:

(iv) detecting a temperature in an apparatus; and

10 (v) varying the degree of the enhancing conversion on the
image data, in accordance with the temperature detected in
the step (iv).

17. The liquid crystal display control method as defined
15 in claim 16, further comprising the steps of:

(vi) referring to a table memory that stores an enhancing
conversion parameter specified by the image data of the
directly previous vertical period and the image data of the
current vertical period;

20 (vii) performing an operation on the image data so as to
enhance the image data, using the enhancing conversion
parameter; and

(viii) multiplying output data as a result of the step (vii)
by a coefficient corresponding to the signal type detected in
25 the step (i) and the temperature detected in the step (iv).

18. The liquid crystal display control method as defined in claim 16, further comprising the steps of:

(vi) referring to a first table memory that stores an enhancing conversion parameter specified by the image data of the directly previous vertical period and the image data of the current vertical period, the first table memory being referred to in a case where the input image data is a progressive signal;

(vii) referring to a second table memory that stores an enhancing conversion parameter specified by the image data of the directly previous vertical period and the image data of the current vertical period, the second table memory being referred to in a case where the input image data is an interlace signal;

(viii) performing an operation on the image data so as to enhance the image data, using the enhancing conversion parameter read out from the first or second table memory in accordance with the signal type detected in the step (i); and

(ix) multiplying output data as a result of the step (viii) by a coefficient corresponding to each temperature detected in the step (iv).

19. The liquid crystal display control method as defined in claim 16, further comprising the steps of:

(vi) referring to first table memories that store enhancing conversion parameters that correspond to respective

temperatures in the apparatus and are specified by the image data of the current vertical period and the image data of the directly previous vertical period, the first table memories being referred to in a case where the input image data is a progressive signal;

(vii) referring to second table memories that stores enhancing conversion parameters that correspond to respective temperatures in the apparatus and are specified by the image data of the current vertical period and the image data of the directly previous vertical period, the second table memories being referred to in a case where the input image data is an interlace signal; and

(viii) in accordance with the signal type detected in the step (i) and the temperature detected in the step (iv), performing an operation on the image data so as to enhance the image data, using the enhancing conversion parameter read out from the first or second table memory.

20. The liquid crystal display control method as defined in claim 16, further comprising the steps of:

(vi) referring to table memories that store enhancing conversion parameters that correspond to respective temperatures in the apparatus and are specified by the image data of the directly previous vertical period and the image data of the current vertical period; and

(vii) performing an operation on the image data so as to

enhance the image data, using the enhancing conversion
parameter read out from the table memory with reference to a
result of comparison between a switching temperature
determined by the signal type detected in the step (i) and the
5 temperature detected in the step (iv).

21. The liquid crystal display control method as defined
in claim 20, further comprising the steps of:

10 (viii) performing, on temperature data corresponding to
the temperature detected in the step (iv), a predetermined
operation corresponding to each signal type of the input
image data;

(ix) comparing the temperature after being subjected to
the predetermined operation with predetermined threshold
15 temperature data; and

(x) in accordance with a comparison in the step (ix),
generating a switching control signal for switching and
controlling the enhancing conversion parameters.

20 22. The liquid crystal display control method as defined
in claim 20, further comprising the steps of:

(viii) comparing temperature data corresponding to the
temperature detected in the step (iv) with predetermined
threshold temperature data corresponding to each signal type
25 of the input image data; and

(ix) in accordance with a comparison in the step (viii),

generating a switching control signal for switching and controlling the enhancing conversion parameters.

23. A program for a computer controlling a liquid crystal display apparatus including I/P conversion means that converts an interlace signal to image data of a progressive signal, in a case where input image data is an interlace signal, the liquid crystal display apparatus correcting optical response characteristics of a liquid crystal display panel by performing an enhancing conversion of the image data in accordance with image data of a directly previous vertical period and image data of a current vertical period, in such a manner as to causing the liquid crystal panel to have a transmittance specified by the image data, within a predetermined period of time,

the program causing the computer to perform a step of varying a degree of the enhancing conversion of the image data, in accordance with a result of detection of whether a signal type of input image data is a progressive signal or an interlace signal.

24. A recording medium storing a program for a computer controlling a liquid crystal display apparatus including I/P conversion means that converts an interlace signal to image data of a progressive signal, in a case where input image data is an interlace signal, the liquid crystal

display apparatus correcting optical response characteristics
of a liquid crystal display panel by performing an enhancing
conversion of the image data in accordance with image data of
a directly previous vertical period and image data of a current
5 vertical period, in such a manner as to causing the liquid
crystal panel to have a transmittance specified by the image
data, within a predetermined period of time,

the program causing the computer to perform a step of
varying a degree of the enhancing conversion of the image
10 data, in accordance with a result of detection of whether a
signal type of input image data is a progressive signal or an
interlace signal.